Case Study No. 16 Waterborne Coatings
Northshore Wood Products
Duluth, MN

Background

Northshore Wood Products manufactures gift and decorative accessories such as clocks, shelves, and plate racks. Some small fixture work also is done on a contract basis. There are twenty employees; work is done by hand and all of their products are finished. The main wood species used is oak, although other species are used. Northshore offers eight stain colors on any of their products; the most popular is the medium oak finish. The decision to use waterborne coatings was prompted by a problem with disposal of rags used to hand wipe their solvent-borne stains.


Product sample

Manufacturing and Coating Operations

Northshore Wood Products purchases kiln-dried lumber and does all cutting and shaping on-site for most orders. Occasionally, a larger order is out-sourced to another company for shaping. All pieces are sanded and finished. The first step of the finishing process for smaller parts is to dip them into the waterborne stain. After dipping, the pieces are immediately hand wiped to removed excess stain and are placed on racks to dry. Stain is hand wiped onto some of the larger parts that cannot be dipped.


Sealer spray booth

The pieces then are moved to the spray booth where the sealer coat is applied using an HVLP gun. The parts are racked again, and allowed to dry. Some pieces receive a coat of sealer on both sides. Once the seal coat is dry (35 to 40 minutes per side), the pieces are sanded to smooth down any grain raise that has occurred. The topcoat is applied with an HVLP gun and the pieces once again are racked to dry before being packaged for shipping.

Cleaning Operations

Before switching to the waterborne finishing system, disposal of cleaning rags from the solvent-borne system was a major problem for Northshore. In 1995, the local waste disposal facility tightened the requirements for products it would accept for incineration. When the facility stopped accepting solvent-borne stain rags from Northshore, it became apparent that exploring other stain options was necessary. The solvent-borne

stain rags were classified as hazardous waste and could only be disposed of at high cost. With the waterborne system however, cleaning rags can be disposed of in Northshore's dumpster at no additional cost. The coating lines and spray guns are drained and cleaned daily. The waterborne coatings are extremely hard when dry, so Northshore uses a special cleaning solution designed by their coating manufacturer to clean the waterborne coatings from the equipment.

Conversion to Waterborne Coatings

The switch from solvent-borne to waterborne coatings was a long and complicated process. Northshore tried products from several different coating manufacturers, but none provided an acceptable waterborne stain, sealer, or topcoat. Northshore then turned to another coating supplier, Van Technologies. As a smaller supplier, Van Technologies provided personal service not offered by the larger suppliers. Problems with the coatings were immediately addressed and quickly resolved. A suitable stain was developed, solving the hazardous waste generation and disposal issue. As the product evolved, the clarity and uniformity of the stains improved, although the quality was not as good as the original solvent-borne system. Necessary reformulations were performed in a timely manner. In short, Van Technologies listened to what Northshore needed and created a coating system to achieve the desired result. The process was lengthy; it took months to create the right coatings, and the process is continuing to evolve. Initially, the waterborne sealer produced a very cloudy finish that was unacceptable to Northshore. To avoid an inferior finish, but still use the waterborne products, two coats of waterborne topcoat were applied. One coat replaced the seal coat, and the other functioned as the typical topcoat. While this system produced a high-quality finish, the cost was higher because the topcoat is more expensive. Fortunately, the problems with the waterborne sealer were corrected and Northshore now applies one coat of waterborne sealer and one coat of waterborne topcoat. The result is a quality finish using waterborne stains, sealers, and topcoats.

Because the majority of their pieces are small, Northshore applies their stain by dipping the product into the stain container. After the switch to waterborne coatings, the dipping process caused several problems. The stain was forming bubbles on the surface of the product, causing an inconsistent finish. There also were problems with the waterborne stain spoiling; wood spores were contaminating the stain when pieces were dipped in the stain container. Northshore began spraying the stains in an attempt to eliminate these problems and also to reduce the coating time and grain raise. Unfortunately, the grain raise was not decreased and the spraying actually slowed the process down. At this point, Van Technologies reformulated the stain. They decreased the surface tension to prevent the bubbling and added a fungicide to prevent the wood spores from spoiling the stain. This reformulation allowed Northshore Wood Products to return to the original dipping process.

Northshore has not experienced many problems with the dry time of their waterborne coatings. They have installed several fans to keep the air in the facility circulating, and the time it takes for the operators to move the product through the finishing process usually is sufficient for the coating to dry between steps. Grain raise also has not been

a prominent problem. The new sealer coats well and holds the grain down. Light sanding before the topcoat is applied eliminates any grain raise that does occur and the topcoat smooths out the final finish.

The operators went through a period of adjustment while the change was being made, but are now happy with the waterborne finishes. The elimination of the smell associated with the solvent-borne coatings and reduction in health risks made the adjustment to the new application techniques required by the waterborne coatings worthwhile.

Advantages of the waterborne system are numerous. The elimination of the hazardous waste generation and subsequent disposal costs was one immediate benefit that prompted the switch. The reduction in fire hazards and improved working environment for the operators also were considerations that began the investigation into the waterborne coatings. Also, when Northshore was using the solvent-borne coatings, the humidity produced by the nearby lake would cause blushing of the lacquers, a problem eliminated with the waterborne topcoats.

Solvent-borne coatings are still in use for the natural finished oak products (no stain is applied) because Northshore has not found a waterborne coating that can produce the amber color the solvent-borne coatings add to the wood color. However, natural finish items make up only one percent of total sales, making the VOC/HAP emissions and waste disposal problems from them minimal.

Costs

The costs of the conversion were relatively low, mainly because there was not a lot of equipment to be replaced. Nozzle tips for the HVLP guns were changed to a different size, but the pressure pots were not replaced with stainless steel. Instead, the pots were sprayed with a coating of the waterborne product to seal them, and Northshore has not experienced any problems with this method.

The ongoing cost of using the waterborne coatings is higher than that of the solvent-borne system. This is because the waterborne coatings cost more per gallon and have approximately equivalent coverage. Normally, the coverage with a waterborne product is greater because of the increased solids content. The coverage was not increased for Northshore partially because of the increased thickness of the sealer to help in reducing grain raise. In terms of cost per square foot coated, the waterborne system costs approximately 17 percent more. However, Northshore feels this cost increase is worthwhile due to the increased safety of the work environment.

Emissions

Because of the size of their operation, Northshore has never had an emissions problem, but the switch to waterborne coatings has nearly eliminated HAP emissions and reduced VOC emissions. The original coatings produced a total of 2.18 tons of VOCs per year and 2.12 tons of HAPs per year. With the new waterborne finishing

system, these emissions have been reduced to 0.38 ton of VOC per year and 0.01 ton of HAP per year.

Customer Feedback

Customer response was negative at the beginning; there were complaints that the new product did not match in color with the old product. There also were complaints about the increased roughness of the finish. As the coating quality improved, especially the sealer, the negative comments decreased. In fact, the waterborne topcoat provides a more durable finish than the solvent-borne lacquers did.